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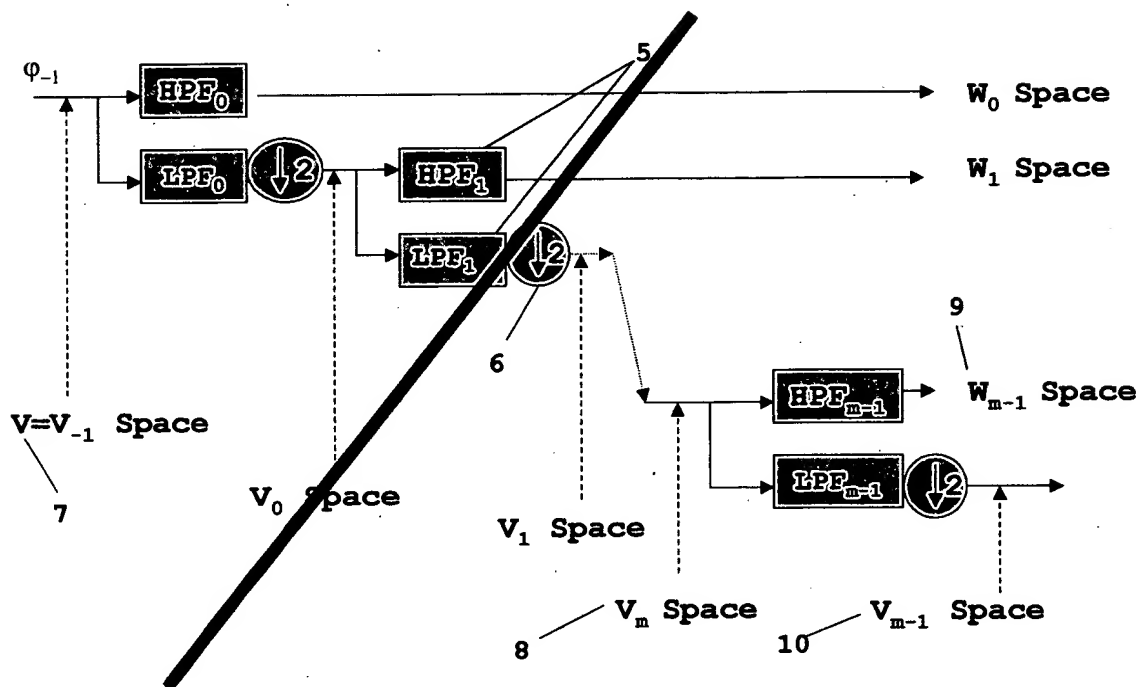
15

FIG. 1 Wavelet Tiling of an N-Point Digital t-f Space
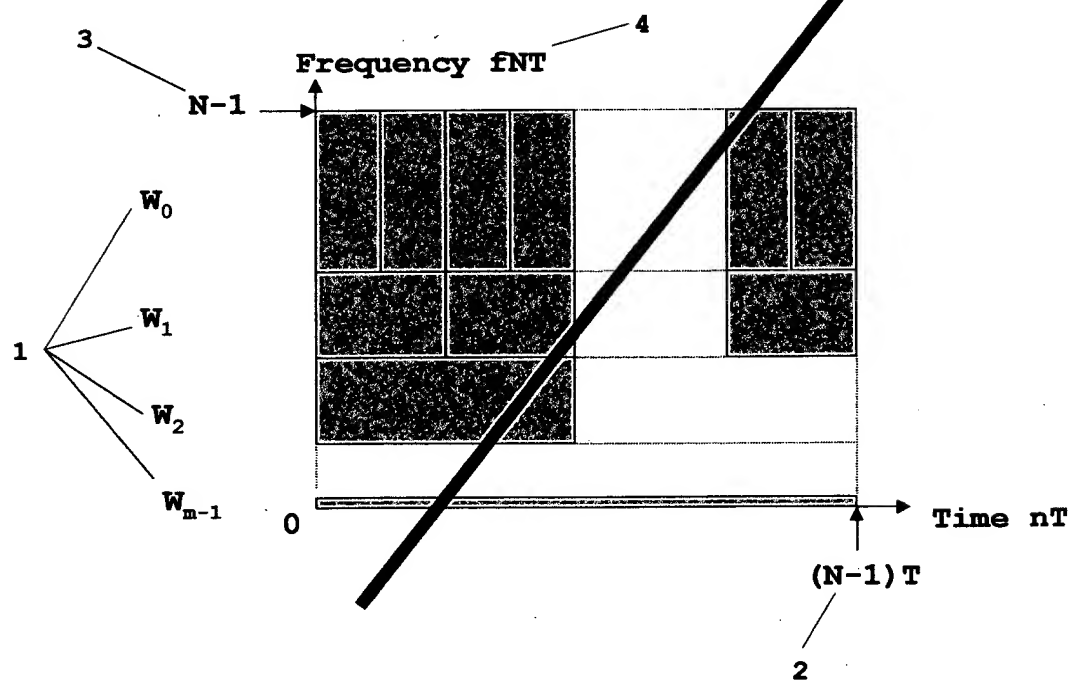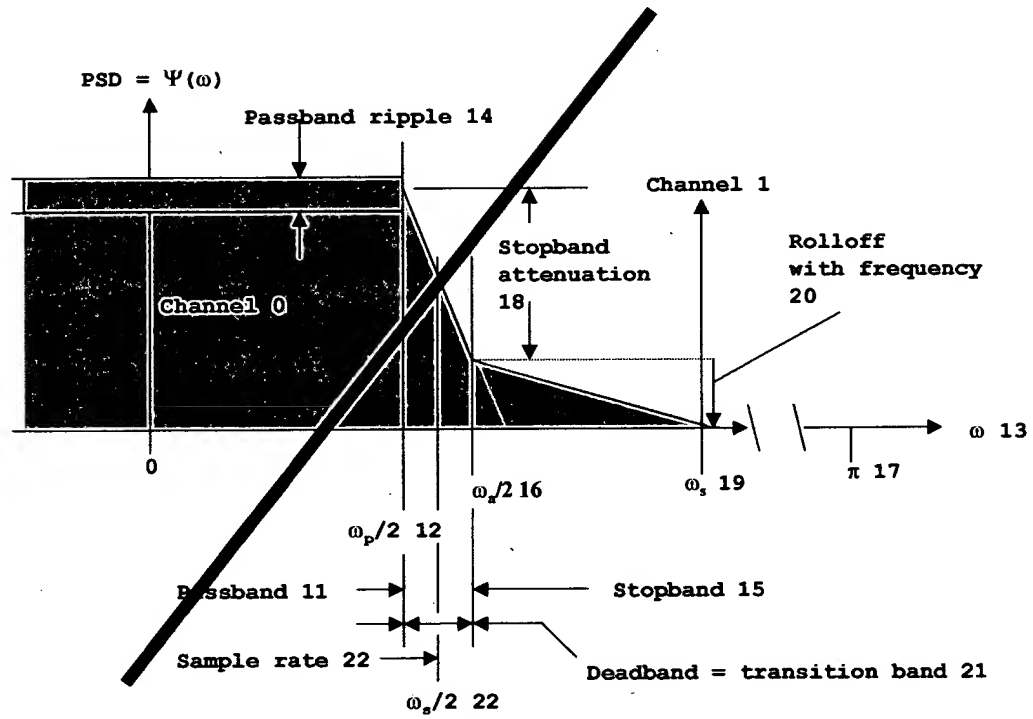
FIG. 2 Wavelet Iterated Filter Bank for Tiling t-f Space in FIG. 1

FIG. 3 PSD Requirements for Communications

PSD = $\Psi(\omega)$

Passband ripple 14

Channel 1

Stopband attenuation 18

Rolloff with frequency 20

Channel 0

0

$\omega_p/2$ 12

$\omega_s/2$ 16

ω_s 19

π 17

ω 13

Passband 11

Stopband 15

Sample rate 22

$\omega_s/2$ 22

Deadband = transition band 21

5

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FIG. 4   LS Metrics and Cost Function

Design Parameters

23

- L, M, n_fft
- ω_p, ω_a, ω_s
- {h}
- metric weights {w(metric)}

24

Passband Eq. 23
Stopband Eq. 23
Deadband Eq. 24

J(band)
= h_f' R h_f Eigenvalue
= Norm($\delta\psi$)   LS

25

ISI Eq. 25
ACI Eq. 26

J(Interference)
= h_f' R h_f Eigenvalue
= Norm($\delta\psi$)   LS

26

LS Cost equation

$J = \sum$ w(metrics) J(metrics)

metrics = passband, stopband, deadband, ISI, ACI

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52
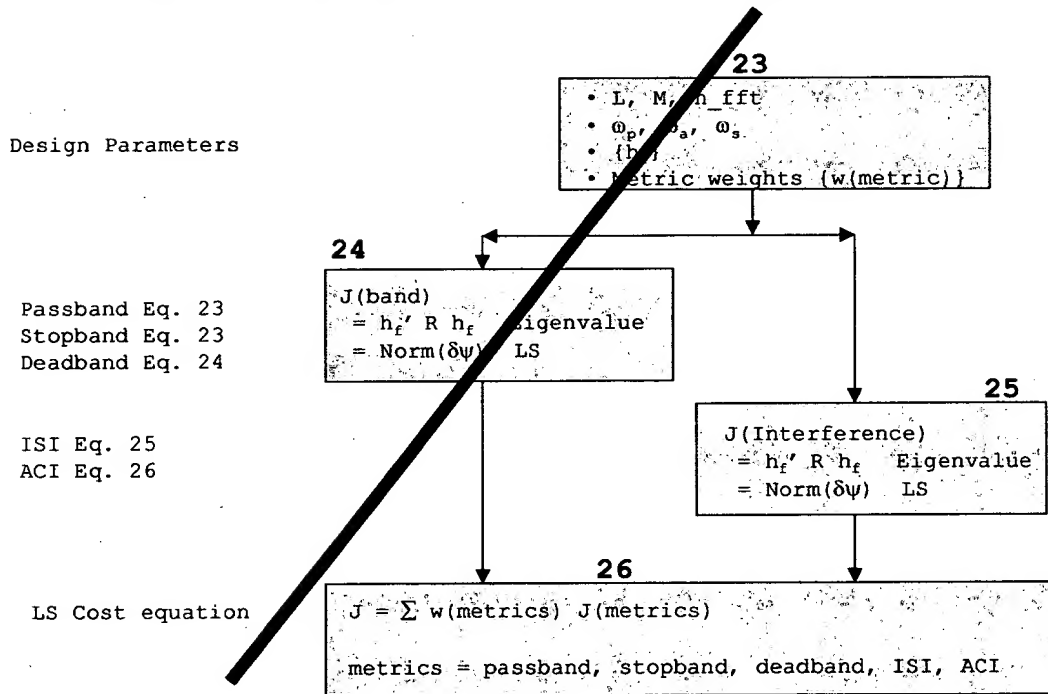
FIG. 5 LS Recursive Solution Algorithm

Start

29 i=0

40
- Reset i=0
- Select new {w(metrics)}

30 Select Design Parameters

34
- ...se new {h$_f$}
- Step i=i+1

31 Calculate Band Metrics

32 i=0 ?

33 Find {h$_f$} at step i=0 to minimize cost J

No

35 Calculate Interference Metrics

36 Calculate Cost J

37 Find {h$_f$} to minimize cost J

Inner Loop: Recursive LS Solution 28

Outer Loop 27

38 Convergence to solution ?

Yes   No

39 Meet performance goals ?

Yes   No

41 Solution set {h$_f$}

Solution

5

FIG. 6 PSD for New Waveform and Square-Root Raised-Cosine

Power spectral density PSD, dB 42

Normalized frequency, symbol rate 43

Legend:
- New Waveform   44
- Sq-Rt R-C with 0.22=alpha   45
- Sq-Rt R-C with 0.40=alpha   46

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54
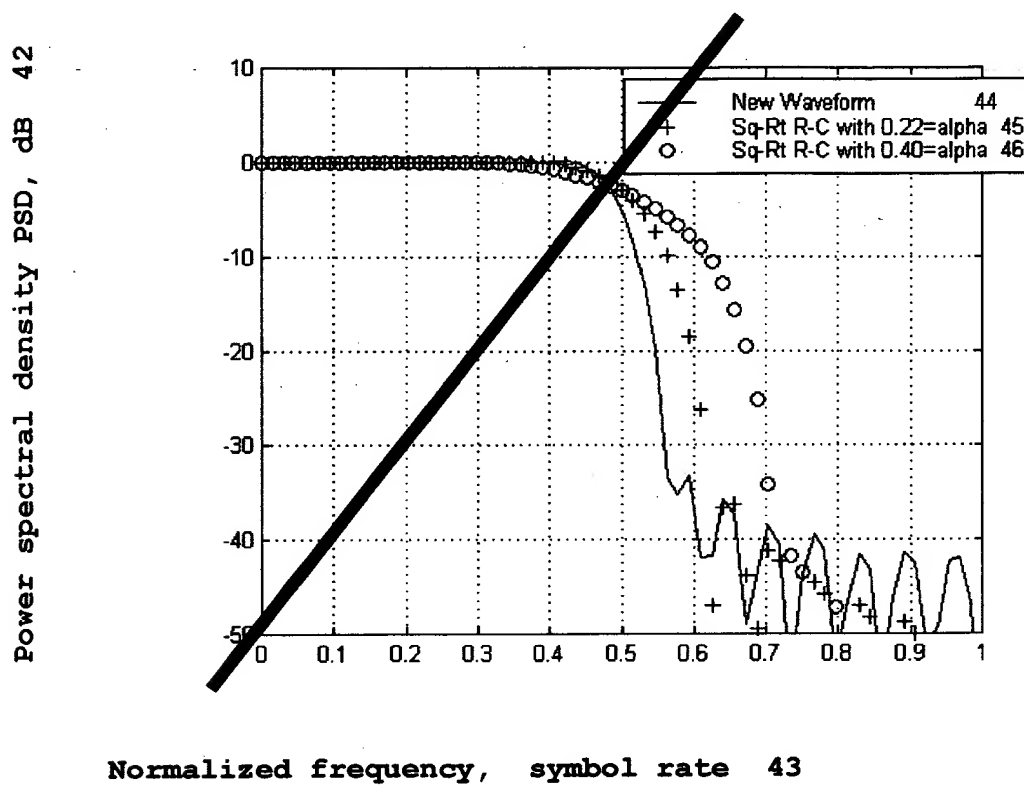
FIG. 7 PSD for New Waveform BEM and GMSK

Power spectral density PSD, dB 47
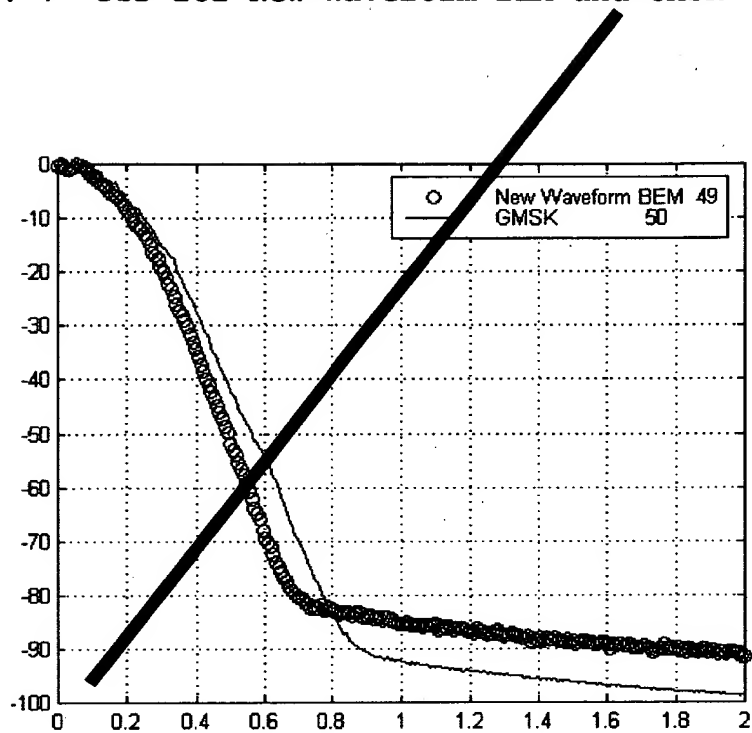
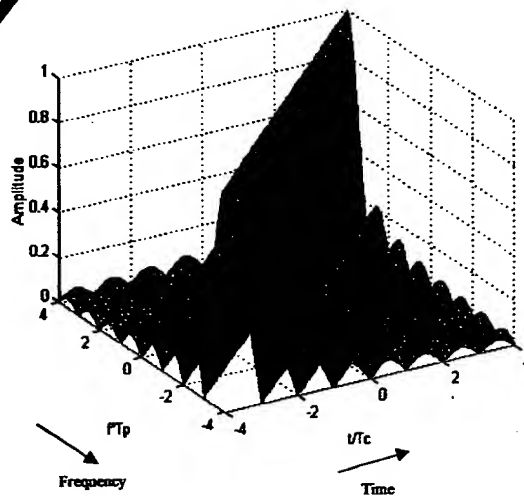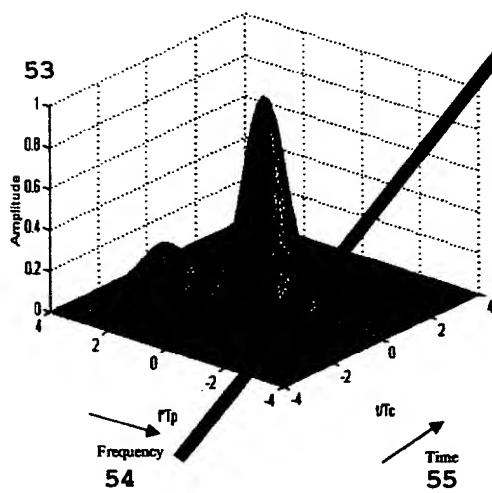Normalized frequency, bit rate 48

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FIG. 8   Radar Ambiguity Functions of New Waveform and Unweighted Chirp Waveform

New Wavelet Ambiguity Function **51**

Unweighted Chirp Ambiguity Function **52**